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Patent
TS-0982 (US)
JDA

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Jennifer D. Adamson
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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF APPEALS AND INTERFERENCES

In re application of)
)
EIT DRENT ET AL)
)
Serial No. 09/804891)
)
Filed March 13, 2001)
)
PROCESS FOR THE CARBONYLATION)
OF PENTENENITRILE)
)

Group Art Unit 1621
Examiner P. A. Zucker
January 17, 2003

ASSISTANT COMMISSIONER FOR PATENTS
Washington, DC 20231

Sir:

APPELLANT'S BRIEF

The following brief is on appeal of a final rejection of Claims 1-23 of the above-identified U.S. patent application. The final rejection was contained in an Office Action mailed on July 30, 2002, and a Notice of Appeal was mailed by Applicant on October 22, 2002. This brief is filed in triplicate. Please charge the fee for filing of this brief to Shell Oil Company Deposit Account No. 19-1800. It is respectfully requested that the Board consider the following arguments and reverse the final rejection of Claims 1-23 in the above-identified application.

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REAL PARTY IN INTEREST

The invention of the present application is assigned to Shell Oil Company, which is the real party of interest in the present appeal.

RELATED APPEALS AND INTERFERENCES

Appellant, and appellant's legal representative, are not aware of any appeals or interferences that directly affect or could directly be affected by or have a bearing on the Board's decision in the present appeal.

STATUS OF THE CLAIMS

Claims 1-23 stand finally rejected under 35 U.S.C. §103(a). Rejection of Claims 1-23 is presently appealed.

STATUS OF AMENDMENT

An After Final Amendment under 37 CFR §1.116(b) accompanies this Appeal Brief.

SUMMARY OF THE INVENTION

The invention is a process for the carbonylation of pentenenitrile to prepare 5-cyanovaleric acid or its ester in the presence of a catalyst system and to a process to prepare ε-caprolactam wherein such a carbonylation process is used.

ISSUES

- 1) Are Claims 1-13 unpatentable over Sielkin US 5,679,831 ('831) in view of Drent et al EP 0495548 A2 ('548) under 35 USC §103(a)?
- 2) Are Claims 14-23 unpatentable over Sielkin US 5,679,831 ('831) further in view of Drent et al EP 0495548 A2 ('548) and further in view of Di Cosimo et al US 6,077,955 ('955) under 35 USC §103(a)?

GROUPING OF CLAIMS

The claims stand or fall together .

ARGUMENTS

1) Rejection of Claims 1-13 over the '831 Reference in view of the '548 Reference

To establish a *prima facie* basis for obviousness, three criteria must be met. First, there must be some suggestion or motivation, either in the reference itself or in the knowledge generally available to one of ordinary skill in the art, to modify the reference. Second, there must be a reasonable expectation of success. Finally, the prior art references must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination must be found in the prior art, and not based on applicant's disclosure [MPEP § 2142; *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).]

In this case, there is no teaching or suggestion in the references to modify the references. As noted by the Examiner, the instant application is distinguished from US'831 in that US'831 does not teach the simple hydrocarbon linked bidentate ligand of the instant application. As shown in Comparative Example C of the instant application, if the conditions and the ligand of US'831 are applied to the carbonylation of pentenenitrile, no catalyst activity is observed. There is no suggestion in the reference that would lead the person skilled in the art to change the bridging group in order to accomplish the carbonylation of pentenenitrile. The Examiner also notes that EP'548 teaches the use of 1,3-(di-tert-butyl phosphino)-propane for use in the carbonylation of olefins and points out Example XIII describing the carbonylation of cyano-ethene, resulting in the branched product 2-cyano methyl propionate. The process of the instant invention, however, results in a linear product. Specifically, the instant invention is directed toward the carbonylation of pentenenitrile to prepare 5-cyanovaleric acid or its ester, a linear product. Applicants respectfully submit that one skilled in the art would not have expected that if the process of the invention were to be carried out on the larger pentenenitrile, that such high linearities as shown in the Examples

would be obtained. The Examiner asserts that the invention would be obvious due to the “motivation” to “employ a less complex expensive catalyst in the process of Sielckin to improve the overall profitability of the process for the synthesis of ϵ -caprolactam”. However, this is not a proper basis on which to assert obviousness.

2) Rejection of Claims 14-23 over the ‘831 Reference, further in view of the ‘548 and ‘955

References

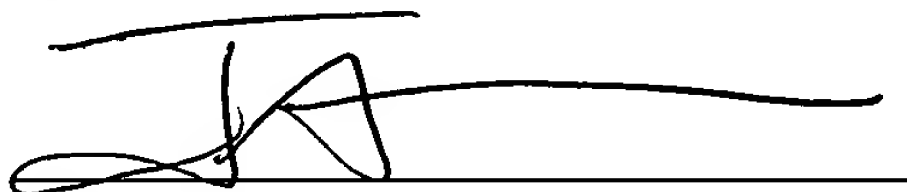
The Examiner combines these references to argue that it is obvious to produce ϵ -caprolactam using a method that incorporates the carbonylation of pentenenitrile as in the instant invention. There is no suggestion in the three references for such a combination. Additionally, the Examiner asserts that the motivation would be to improve the overall profitability of the process for the synthesis of ϵ -caprolactam. However, this is not a proper basis on which to assert obviousness.

CONCLUSION

For the reasons set forth above, the Applicants assert that the rejections made by the Examiner are improper. Applicants therefore respectfully request that the Board reverse the Examiner’s rejections.

Respectfully submitted,

EIT DRENT ET AL



Their Attorney, Jennifer D. Adamson
Registration No. 47,379
(713) 241-3901

P.O. Box 2463
Houston, TX 77252-2463

APPENDIX

CLAIMS ON APPEAL ARE 1-23:

1. A process for preparing a 5-cyanovaleric acid or its ester comprising reacting pentenenitrile with carbon monoxide and water and/or an alcohol in the presence of a catalyst system, comprising

- (a) a source of Group VIII metal and
- (b) a bidentate phosphine, arsine and/or stibine ligand, wherein the bidentate ligand has the general formula (I):



wherein M^1 and M^2 are independently P, As or Sb, R is a divalent organic bridging group, which bridging group comprises a chain of 3 to 5 atoms directly connecting the 2 phosphorus atoms, which chain consists of carbon atoms and optionally a nitrogen, oxygen or sulphur atom or a silano or dialkylsilicon group, which alkyl groups independently comprise from 1 to 4 carbon atoms, and R^1 - R^4 represent the same or different optionally substituted tertiary alkyl groups,

- (c) an acid having a pKa less than 3, as measured at 18 °C in an aqueous solution.

- 2. The process of claim 1 wherein the bidentate ligand of formula (I) is a bisphosphine ligand and R^1 - R^4 represent the same tertiary alkyl groups.
- 3. The process of claim 1 wherein R^1 - R^4 represent tertiary butyl groups.
- 4. The process of claim 1 wherein R is a C₃-C₅ alkylene group.
- 5. The process of claim 4 wherein the bidentate ligand is 1,3-bis(di-tert.butylphosphino)propane or 1,2-bis(di-tert.butylphosphinomethyl)benzene.
- 6. The process of claim 1 wherein the Group VIII metal is palladium.
- 7. The process of claim 4 wherein the Group VIII metal is palladium.
- 8. The process of claim 1 wherein the molar ratio between the ligand (b) and the metal (a) is in the range of 1:1 to 5:1.
- 9. The process of claim 8 wherein the Group VIII metal is palladium.
- 10. The process of claim 1 wherein the reaction is carried out at a temperature in the range of about 80 to about 125 °C.

11. The process of claim 4 wherein the reaction is carried out at a temperature in the range of about 80 to about 125 °C.
12. The process of claim 6 wherein the reaction is carried out at a temperature in the range of about 80 to about 125 °C.
13. The process of claim 1 wherein the molar ratio of acid compound (c) and metal (a) is between 1:1 and 5:1.
14. A process for preparing ε-caprolactam comprising:
 - (i) reacting pentenenitrile with carbon monoxide and water and/or an alcohol in the presence of a catalyst system, comprising
 - (a) a source of Group VIII metal,
 - (b) a bidentate phosphine, arsine and/or stibine ligand, wherein the bidentate ligand has the general formula (I):



- wherein M^1 and M^2 are independently P, As or Sb, R is a divalent organic bridging group, which bridging group comprises a chain of 3 to 5 atoms directly connecting the 2 phosphorus atoms, which chain consists of carbon atoms and optionally a nitrogen, oxygen or sulphur atom or a silano or dialkylsilicon group, which alkyl groups independently comprise from 1 to 4 carbon atoms, and R^1 - R^4 represent the same or different optionally substituted tertiary alkyl groups, and
- (c) an acid having a pKa less than 3, as measured at 18 °C in an aqueous solution thereby producing 5-cyanovaleric acid or ester,
- thereby producing 5-cyanovaleric acid or ester;
- (ii) reducing the 5-cyanovaleric acid or ester to provide 6-aminocaproic acid or ester, and
 - (iii) cyclising the 6-aminocaproic acid or ester to provide ε-caprolactam.
15. The process of claim 14 wherein a mixture of branched and linear carbonylation products as obtained in step (i) is used in step (ii) and/or (iii).
 16. The process of claim 14 wherein the bidentate ligand of formula (I) is a bisphosphine ligand and R^1 - R^4 represent the same tertiary alkyl groups.
 17. The process of claim 14 wherein R^1 - R^4 represent tertiary butyl groups.
 18. The process of claim 14 wherein R is a C₃-C₅ alkylene group.

19. The process of claim 18 wherein the bidentate ligand is 1,3-bis(di-tert.butylphosphino)propane or 1,2-bis(di-tert.butylphosphinomethyl)benzene. .
20. The process of claim 14 wherein the Group VIII metal is palladium.
21. The process of claim 18 wherein the Group VIII metal is palladium.
22. The process of claim 14 wherein the molar ratio between the ligand (b) and the metal (a) is in the range of 1:1 to 5:1.
23. The process of claim 14 wherein the reaction is carried out at a temperature in the range of about 80 to about 125 °C.